



TITLE:

# Quasifree-Scatterings and Quasifree-Reactions on Light Nuclei (NUCLEAR SCIENCE RESEARCH FACILITY - Particle and Photon Beams)

AUTHOR(S):

Yoshimura, Tadahiko; Kakigi, Shigeru

---

CITATION:

Yoshimura, Tadahiko ...[et al]. Quasifree-Scatterings and Quasifree-Reactions on Light Nuclei (NUCLEAR SCIENCE RESEARCH FACILITY - Particle and Photon Beams). ICR Annual Report 1996, 2: 55-55

ISSUE DATE:

1996-03

URL:

<http://hdl.handle.net/2433/65695>

RIGHT:

## References

1. T. Shirai, *Bull. Inst. Chem. Res., Kyoto Univ.*, **73**, No.1, 1995, p78.
2. A. Noda, *Bull. Inst. Chem. Res., Kyoto Univ.*, **73**, No.1, 1995, p27.

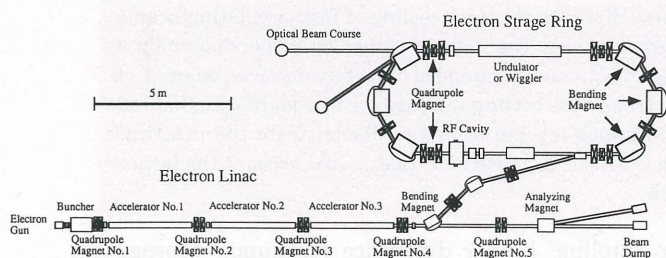


Figure 1. Layout of the linac and the KSR.

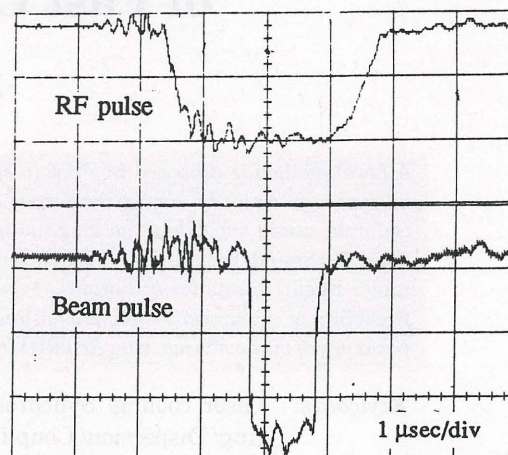


Figure 2. Input RF pulse of the third accelerating structure and the accelerated beam pulse.

## Quasifree-Scatterings and Quasifree-Reactions on Light Nuclei

Tadahiko Yoshimura and Shigeru Kakigi

The alpha cluster in a nucleus is expected to be softened compared with the alpha particle. To investigate experimentally the softening of the alpha cluster, it is desirable to measure the ratio of the cross section for the quasifree-scattering to that for the quasifree-reaction and to compare it with the corresponding ratio for the free processes.

**Keywords:** alpha cluster / Quasifree process

Alpha cluster structures have been studied both experimentally and theoretically and alpha clusters have been recognized to exist in many nuclei. This fact is due to the tight binding of the alpha particle with the binding energy of about 7 MeV/nucleon, large compared with neighboring nuclei. However, the alpha cluster in a nucleus is expected to be softened slightly through interactions with other nucleons surrounding the alpha cluster. An interesting problem arises: how much is the degree of the softening of the cluster.

The cluster structures of light nuclei have been investigated experimentally through quasifree processes at intermediate energies. In these processes, the projectile interacts directly with the alpha cluster in the target nucleus and the remaining part of it is playing as a spectator. In the quasifree-scattering (QFS), the projectile is quasi-elastically scattered from the alpha cluster. Another process is possible, that is the quasifree-reaction (QFR) [1], in which the collision of the projectile and the alpha cluster leads

to two-body rearrangement reactions. Experimentally it is desirable to measure the ratio of the cross section for the QFS to that for the QFR in order to cancel distortion effects. If the softening of the alpha cluster is assumed, the ratio for the quasifree processes is expected to decrease compared with the corresponding ratio for the free processes.

The experiments were performed with an 120 MeV alpha-particle beam and a 296 MeV proton beam from the AVF cyclotron and the ring cyclotron, respectively, at RCNP of Osaka University. The target nuclei were  ${}^6\text{Li}$ ,  ${}^7\text{Li}$ ,  ${}^9\text{Be}$  and  ${}^{12}\text{C}$ . Our preliminary results are suggesting the softening of the alpha cluster in  ${}^6\text{Li}$ . Further analyses are now in progress. The experiments were performed at RCNP in E46 and R04 collaborations.

## References

1. Okihana A, Yoshimura T, Kakigi S, Ushiro K and Sekioka T, *RCNP Annual Report 1994*, 29.